Navy Topic No: N96-258

Efficient Channel Coding, Inc.
600 Safeguard Plaza, Suite 100
Brooklyn Heights, OH 44131
http://www.eccincorp.com

Efficient Channel Coding, Inc. (ECC) provides real-world digital communication solutions for some of the world's largest companies. Its technology innovations increase the efficiency of today's most advanced satellite, wireless, and wire-line communication systems. It provides expert engineering for satellite communication systems, optical communication systems, terrestrial wireless communication systems, advanced air interface design, and standards participation.

ECC POC: Mark Vanderaar
216-635-1610
mark@eccincorp.com

Navy POC: Nina Tran
619-524-7755
nha.tran@navy.mil

SBIR Investment: $837.6K

High-Coding-Gain, High- Rate Turbo Product Codes, for Robust Direct Broadcast Satellite Systems

About the Technology

ECC has developed a powerful class of forward error-correcting codes, which outperform forward error-correction codes used in today's communication systems. These codes, called turbo product codes (TPCs), use a high-speed, flexible, application-specific integrated circuit (ASIC) and a low-speed, flexible, software-based decoder architecture that correct transmission errors, thus increasing the reliability of digital communication links. TPCs are ideally suited to systems where large coding gain is required, but only a limited overhead is acceptable. For example, one TPC evaluated offers a code rate of 4/5 and a coding gain of 7.0 dB at a bit error rate of 10^{-6}, which is 1.5 dB from the Shannon limit. To achieve this performance, three innovative decoding algorithms that exhibit an extreme reduction in complexity over existing techniques were developed. The result is a simple decoder that enabled the construction of a high-speed "turbo-like" codec on a chip.

Benefits to PEO C4I&Space and Other DOD Programs

TPCs significantly outperform codes currently used in today's military. They are used in a wide range of systems including satellite-to-mobile systems and future satellite terminals that will take advantage of the improved performance and the flexible decoding of TPCs. Ships' broadband satellite communication to narrow-band undersea communication have greatly benefited from this technology.

Why TPC Improves the Technology

- TPC flexibility combined with iterative decoding make them extremely useful in links with variable satellite network receivers and variable data rates affected by rain fade or a multi-path interference.
- Improves performance over the most powerful error correction codes used in today's modern digital communications
- Provides an overall increase in the number of data bits that can be transmitted per hertz of frequency.

Military and Commercial Significance

- Advanced Hardware Architectures, Inc. a major seller of error correction ASICs has partnered with ECC to make the technology available to commercial sources.
- ECC has applied TPCs to the next generation direct broadcast satellite and other future satellite communication systems as well as emerging terrestrial systems. These include iPSTAR Broadband Satellite System, Intelsat satellite modems, satellite VSAT networks, wireless networks (IEEE802.16), custom enhanced to WiFi (IEEE802.11b), fiber optical links (ITU-G.709), and wireless public safety modems (TIA-902).
- For military applications, TPCs can be used in satellite-to-mobile systems as well Phase III global broadcast service (GBS) terminals to take advantage of their improved performance (over base lined codes) and their flexible decoding.
- This SPAWAR SBIR effort was instrumental in allowing ECC to grow from three employees and less than $1M in revenue to over 40 employees and more than $10M in revenue.